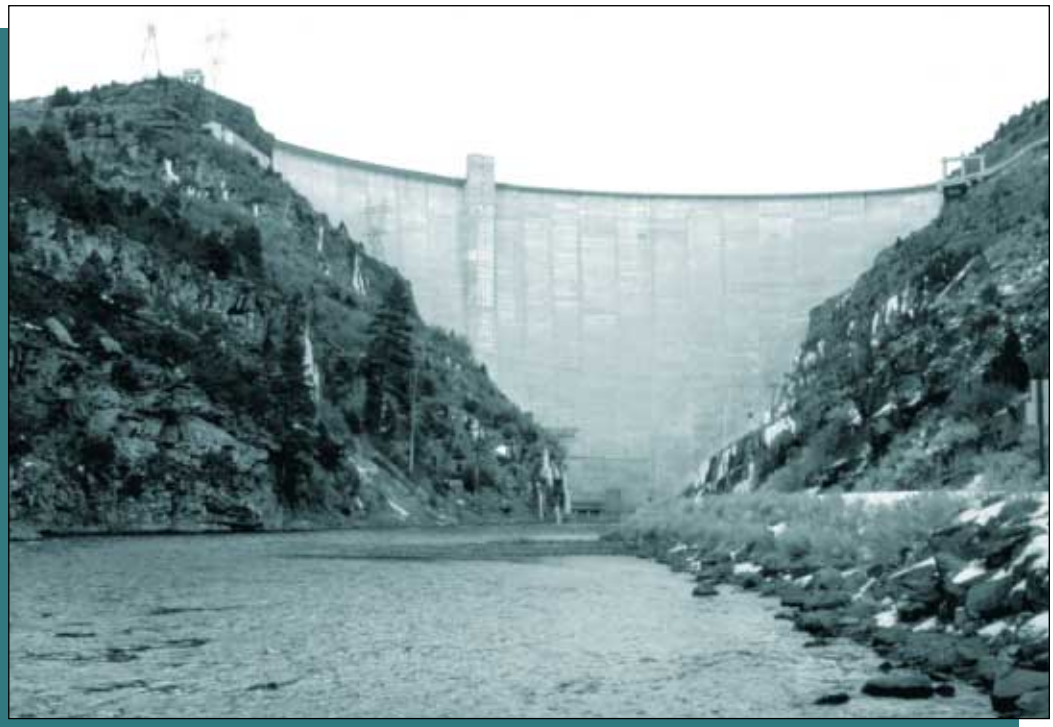
# 2000 Resource Risks



▲ **The Flaming Gorge Dam** in northeastern Utah regulates the flow of the Green River, affecting endangered fish and other riparian species in Dinosaur National Monument and Canyonlands National Park. The National Park Service has been providing input on new flow recommendations to stimulate recovery of endangered fish species and to restore riparian habitat.

Homo sapiens *has become a geophysical force, the first species to obtain that dubious distinction. We have driven carbon dioxide to the highest levels in the last 200,000 years, unbalanced the nitrogen cycle, and contributed to global warming that will ... [create] severe pressure on the national parks, probably within a matter of just decades.*

—E. O. Wilson
Harvard biology professor, naturalist, and author

Environmental histories identify the late 20th century as the period in which human beings recognized that no place on earth is safe from environmental degradation, regardless of its remoteness. Despite appearances, units of the national park system are no exception. Undeterred by park boundaries or the distance of their sources, air and water pollution commonly diminishes park values. Habitat loss and fragmentation reduce populations of plants and animals and influence the spread of exotic species. Other threats arise from within parks and include erosion, vandalism, and overuse of some areas. This reality compels the National Park Service as caretakers of beloved treasures to be vigilant about changes in park natural resources and to intervene as a sophisticated, scientific force for their preservation. The actions of the National Park Service today—some of which are documented here for 2000—to maintain the health of park ecosystems will determine the quality of parks it passes on for the enjoyment of future generations.

## Competition for Water

# River management and the Upper Colorado River Recovery Implementation Program

✎ By John Wullschleger

✉ john_wullschleger@nps.gov
Fishery Biologist, Water Resources Division;
Natural Resource Program Center,
Fort Collins, Colorado

The Colorado River may be the world's most managed, legislated, and litigated river system. The river and its tributaries sustain cities, industry, and agriculture in an arid region. More than 49 dams store water conveyed by canals and aqueducts to locations inside and outside the basin. Overallocation of basin water yield has fueled conflicts among competing interests, making the river ecosystem the major casualty of battles over water to meet human demands. Modification of flow regimes by dams has contributed to the decline of river-dependent species, including those in six units of the national park system. Affected species include the endemic, federally listed endangered Colorado pikeminnow (*Ptychocheilus lucius*), razorback sucker (*Xyrauchen texanus*), humpback chub (*Gila cypha*), and bonytail (*G. elegans*). Proposed actions for the recovery of the species include the reoperation of dams to provide flows that meet life history requirements. Although establishing more natural flow patterns is probably the most important tool for recovery, it is controversial because of its potential impacts on human use.

*"The river ecosystem [is] the major casualty of battles over water to meet human demands."*

While the impairment of rivers in the Colorado River basin by dams affects many species, the most significant river restoration projects are being driven by efforts to recover the four endangered fishes. The U.S. Fish and Wildlife Service is ultimately responsible for recovery, but other agencies and various interest groups are jointly implementing recovery actions within the subbasins. The Upper Colorado River Recovery Implementation Program (hereafter "the program") was formed in 1988 with the goal of recovering the endangered fishes while allowing the continuation of water development in compliance with existing laws. The program initially comprised the Upper Basin Water Users; the U.S. Fish and Wildlife Service; the U.S. Bureau of Reclamation; Western Area Power Administration; the States of Colorado, Utah, and Wyoming; and the environmental community represented by The Nature Conservancy and Environmental Defense. The Colorado River Energy Distribution Association and the National Park Service acquired voting membership in 2000.

In 2000 the program reviewed reports with flow recommendations for the Green River below the Flaming Gorge Dam and the Gunnison River below the Aspinall Project. These rivers are the two largest tributaries to the Colorado River upstream of Lake Powell. Their flows affect natural river functions in Canyonlands (Utah) and Black Canyon of the Gunnison National Parks (Colorado) and in Dinosaur National Monument (Colorado and Utah).

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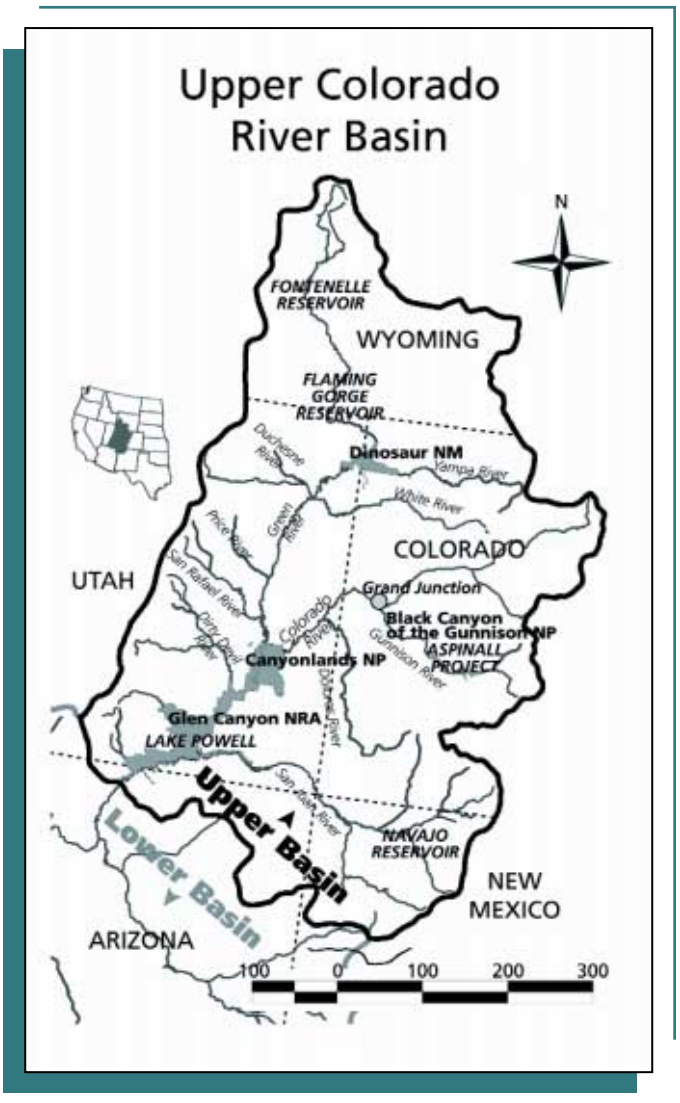


▲ **Major rivers and reservoirs** of the Upper Colorado River basin and the national park system units they affect. NPS Intermountain GIS Office and Natural Resource Information Division

In June, the program adopted flow recommendations for the Green River. In its comments, the National Park Service indicated that these flow recommendations were inadequate to restore riverine processes or meet the needs of the listed species in Dinosaur and Canyonlands. The Park Service was not a voting member at that time. The recommendations were specifically intended to provide benefits in the river between Dinosaur and Canyonlands, where it is believed that fish requirements can be met with lower releases from the dam. The National Park Service is now providing input into the Flaming Gorge Dam Environmental Impact Statement, which will determine how the dam is operated to implement the recommended flows. In addition the NPS Water Resources Division is supporting research on river and riparian species and refining a model to identify flow needs for the purpose of quantifying a federal reserve water right within the monument.

In 2000 the program also considered flow recommendations for the Gunnison River. The National Park Service voted to adopt these recommendations because they represented a legitimate attempt to emulate the natural flow patterns and because the habitat maintenance benefits were well supported by hydrologic data. In addition the recommended flows were consistent with those needed to maintain natural river functions upstream in Black Canyon of the Gunnison National Park. However, the program has yet to resolve differences in the views of its members. Continued opposition by dissenting members could block approval or effect substantial changes of the recommendations.

Flows needed for the recovery of the endangered fishes have yet to be determined for other tributaries, including the Yampa and White Rivers. In addition to containing occupied habitat for the listed species, both rivers contribute to the maintenance of flow and habitat in the Green River in Dinosaur National Monument and Canyonlands National Park. Although it is unclear how tributary flows will be determined, the program will probably affect the decisions.

Riverine habitat managed by the National Park Service is critical for the recovery of the endangered fishes. However, the program's attempts to strike a balance between recovery and water development can constrain the ability of the Service to meet its other resource management responsibilities. Participation in the program challenges the National Park Service to contribute to endangered species recovery in a manner that is consistent with its broader responsibilities of restoring and protecting the river ecosystem in the national parks.

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## Change in status of lynx and black-tailed prairie dog

Two rare mammals are affecting the management of several units in the national park system from Maine to Washington. The U.S. Fish and Wildlife Service listed the Canada lynx *(Lynx canadensis)* as a threatened species in the 48 conterminous United States on 24 March 2000. Eighteen national park units are currently believed to have lynx. The National Park Service and other federal agencies have been working with the Fish and Wildlife Service to improve recovery of the species. The USDA Forest Service has already signed a lynx conservation agreement and both the Park Service and the Bureau of Land Management are attempting to sign similar agreements. These will help the agencies coordinate management efforts until other recovery guidance is in place. In addition to the conservation agreements, a science report and a lynx conservation assessment/strategy are available to help manage this species.

The black-tailed prairie dog *(Cynomys ludovicianus)* was designated a candidate species for listing as threatened under the Endangered Species Act on 4 February 2000. The species is known to occur in at least seven national park units, including Badlands, Wind Cave, and Theodore Roosevelt National Parks; Devils Tower and Scotts Bluff National Monuments; and Ft. Larned and Bents Old Fort National Historic Sites. Several other parks historically supported the prairie dog but do not currently have prairie dogs. The National Park Service is a participant in a federal working group on black-tailed prairie dog conservation, is working with states and Native American tribes on managing the species, and is sponsoring or conducting research on prairie dog ecology in several parks.

▲ **Canada lynx** (top) and black-tailed prairie dog (bottom). (2) Copyright Daniel S. Licht

## Water Pollution

# Mysterious tadpole die-off in Whiskeytown

✎ By Jennifer Gibson

✉ jennifer_gibson@nps.gov
Ecologist, Whiskeytown National Recreation Area, California

Declines in amphibian populations were perhaps one of the most urgent and enigmatic worldwide environmental problems of the late 20th century. Scientists are currently investigating amphibian die-offs in several locations across the United States. Multiple species of frogs, toads, and salamanders and one species of newt are dying off on private, state, and federal lands, including several national parks. Possible causes of the decline include the introduction of nonnative species, increased ultraviolet (UV-B) radiation, acid precipitation, rising global temperatures, pollution, infectious disease, and a combination of factors.

In June 2000, hundreds of dead bullfrog (*Rana catesbeiana*) tadpoles were found in the lake of Whiskeytown National Recreation Area, California. Although the bullfrogs are a nonnative, invasive species in the recreation area, the dead tadpoles alarmed park staff. Amphibians are sentinels of water quality and environmental degradation because of their different life stages (an aquatic larval stage and a terrestrial adult stage), highly specialized physiological adaptations, and specific microhabitat requirements. Because amphibians have been identified as indicator species for the aquatic and terrestrial ecosystems in Whiskeytown National Recreation Area, several explanations for the die-off were investigated.

Iridoviruses and a newly recognized, yeastlike fungus are the only known infectious diseases that cause large die-offs in tadpoles. A histological examination of the dead tadpoles by the USGS National Wildlife Health Center revealed abnormalities in the gills, skin, and oral disks but no sign of known infectious disease. Thus, what was thought to be an amphibian disease outbreak became a water quality issue.

> *"What was thought to be an amphibian disease outbreak became a water quality issue."*

Whiskeytown Lake lies at the confluence of seven major streams that comprise one of the largest watersheds of the Sacramento River. Land use outside the park boundary was considered a potential source of pollution in the arm of the lake in which the die-off occurred. A bioassessment of the watershed revealed a previously unknown abandoned mine that is associated with the Iron Mountain Mine Superfund site, which is well known for having the most acidic waters (pH –3.6) in the world. However, tadpole samples revealed no sign of the heavy metals that are typically associated with acid mine drainage.

The National Park Service now suspects that the most probable cause of the die-off is the introduction of a low-molecular-weight, rapidly metabolized, organic compound. This includes some herbicides and rodenticides, fertilizers, petroleum-based compounds, and several solvents that are associated with the manufacture of illegal substances, such as methamphetamine. Drops of fire retardant, which were numerous in summer 1999, are also suspect because retardants containing sodium ferrocyanide release pure, deadly cyanide when exposed to sunlight. Although the effects of the chemicals associated with retardants are thought to be short-lived, their persistence in the environment is unknown.

▲ **Dead bullfrog tadpoles** float in Whiskeytown Lake, alerting staff to a potential environmental hazard. Investigations during 2000 did not identify infectious disease and heavy metals poisoning as causes and shifted suspicion to chemical contamination of the water as the source of the problem.

Pollutants associated with two-stroke engines (MTBE and PAHs) have also been considered, because even at low concentrations, these compounds can harm aquatic organisms through phototoxicity.

The cause of the tadpole die-off in Whiskeytown Lake has yet to be determined. The tissue abnormalities and deaths of the tadpoles emphasize the pressing need for long-term ecological monitoring. Although monitoring in the Klamath Network of the Inventory and Monitoring Program is not funded yet, Whiskeytown National Recreation Area's future participation in this program may provide critical information about the status of its amphibians and clues to the tadpole die-off.

# Water quality–monitoring partnership on the Pedernales

✎ By John Tiff and Brian Carey

✉ john_tiff@nps.gov
Historian, Lyndon B. Johnson National Historical Park, Texas
✉ brian_carey@nps.gov
Chief, Resources Management and Visitor Protection,
Lyndon B. Johnson National Historical Park, Texas

In December 1996, Lyndon B. Johnson National Historical Park inaugurated a partnership with the Colorado River Watch Network (CRWN) of the Lower Colorado River Authority to assess and monitor the water quality of the upper Pedernales River. The partnership between CRWN and the park was born of a mutual need to gather basic water quality data from the Pedernales, a tributary of the Colorado River. Approximately one mile of the river forms the southern boundary of the park's LBJ Ranch District, the setting for the Texas White House located near Stonewall, Texas.

▲ **Ranger Cynthia Dorminey** calibrates a pH meter that is used biweekly to sample water at two locations on the Pedernales River in Lyndon B. Johnson National Historical Park. She is one of five certified water quality monitors at the park who participate in the cooperative program.

Training, equipment, and support from CRWN have enabled the park to conduct a low-cost, carefully targeted water quality–monitoring program. Two sites in the park are monitored by park staff on a biweekly schedule for temperature, pH, total dissolved solids, dissolved oxygen, nitrate nitrogen, and *E. coli* bacteria. These water quality–monitoring sites are the only ones on the upper Pedernales; only one additional monitoring site exists on the entire river. The data are provided to CRWN staff, who also make periodic site visits to audit the data collection and verify that the methodology used complies with their standards.

Monitors have found consistently high fecal coliform and *E. coli* bacteria counts since the initiation of the monitoring program. Likely sources of water quality degradation include agricultural runoff and failing septic systems in the unincorporated areas of Gillespie County. Based on the high quality and consistency of park observations, the Texas Natural Resource Conservation Commission added this section of the Pedernales River to the Environmental Protection Agency's 303(d) list of impaired surface waters. Monitoring data have also been used in the development of the park's 1999 General Management Plan. In that year, CRWN presented the park with an "Outstanding Partner" award "for exceptional dedication and leadership through superb quality and consistent environmental monitoring."

Late in 2000 the park began a biomonitoring program to gain further information about the river and its health. Twice a year, park staff will collect and identify a sample of the benthic invertebrate fauna. Comparing the samples over time will provide additional indications of changes in water quality in the Pedernales River.

Park management originally entered into this partnership in order to gather baseline data and to ensure that agricultural activities associated with the maintenance of the cultural landscapes at the LBJ Ranch would not further impact the already impaired water quality of the Pedernales River. Along with an increase in the park's standing in the scientific community due to this exemplary partnership have come additional opportunities to develop relationships with new people and organizations in the local community. These relationships will serve as catalysts for the improvement of the overall water quality of the Pedernales River in years to come.

## Virus responsible for amphibian deaths in parks

Researchers and land managers worldwide are concerned about severe and mostly unexplained declines of amphibian populations worldwide, including remote and pristine areas. Die-offs of large numbers of frogs, toads, and salamanders occurred in 1999 and 2000 throughout the United States, including national park units. In late June 2000, hundreds of juvenile spring peepers (*Pseudacris crucifer*) were found dead or dying at several known breeding ponds in Acadia National Park, Maine. The discovery came as a result of an inventory component of a research project funded by the Natural Resource Preservation Program. For the second consecutive year, frogs and salamanders also died in the springtime at Great Smoky Mountains National Park, Tennessee. A partner in the All Taxa Biodiversity Inventory program made the initial discovery; the situation is now being closely monitored by the U.S. Geological Survey.

In both these cases USGS scientists at the National Wildlife Health Center in Madison, Wisconsin, have identified iridoviruses as the probable culprit for the die-offs. Since 1996, when USGS scientists began investigating amphibian mortality, iridoviruses have been associated with numerous tiger salamander (*Ambystoma tigrinum*) die-offs in the western United States and Canada. Little is known about the origin of iridoviral disease, its link with amphibian populations, and how it spreads. When the disease was discovered at Acadia, researchers, park staff, and others using or accessing multiple water bodies in one day were asked to clean field equipment and footwear with a mild bleach disinfectant at each site to prevent transmission of the virus to other wetlands. Researchers going into the field are being asked to look for symptoms and report anything suspicious.

▲ **Spring peeper.**
Copyright J. Harding

## Vandalism and Theft

# Calling for stronger fossil resource protection: A report to Congress

✎ By Julia Brunner and Lindsay McClelland

✉ julia_brunner@nps.gov
Policy and Regulatory Specialist,
Geologic Resources Division, Lakewood, Colorado
✉ lindsay_mcclelland@nps.gov
Geologist, Geologic Resources Division,
Washington, D.C.

The U.S. Senate report accompanying the 1999 Department of the Interior Appropriations Act directed the Secretary of the Interior to develop a report assessing the need for a unified federal policy on the collection, storage, and preservation of fossils on federal lands. Congress further directed the Secretary to consider whether current federal policies adequately prevent deterioration and loss of fossils and maximize their availability for scientific study. Eight federal agencies (National Park Service, Bureau of Land Management, Bureau of Reclamation, Bureau of Indian Affairs, U.S. Fish and Wildlife Service, U.S. Geological Survey, USDA Forest Service, and Smithsonian Institution) went to work on the task.

Despite their contrasting missions, the agencies worked closely to develop a report that explains many of the problems and weaknesses of federal fossil management and proposes a long list of practical solutions. They prepared a background paper and conducted a public hearing in June 1999. Building on this public input, they developed a draft report, which was circulated for public review in November 1999. They then analyzed the public comments and developed the final report, which Secretary Babbitt sent to Congress on 15 May 2000.

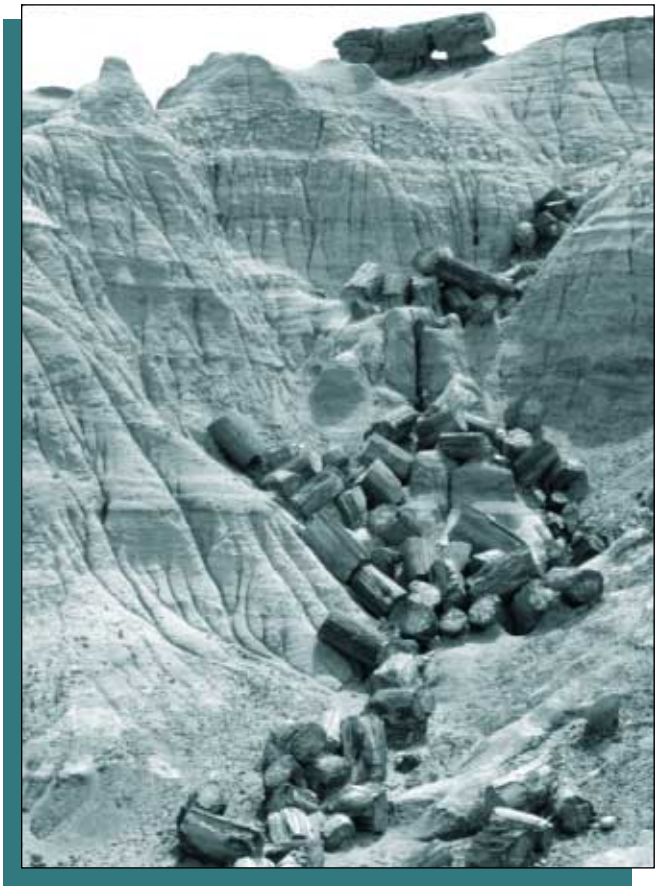
In his transmittal letter, the Secretary recommended that Congress enact legislation to strengthen federal fossil management. The report advocates improving fossil assessment, management, and protection through the development of a coordinated approach that addresses seven basic principles.

First, the report states that any fossil collection on federal lands for purposes other than science, education, or (at appropriate sites) recreation is incompatible with the public interest. Citing the overwhelming majority of public comments, the report opposes opening federal lands to commercial collection.

Next, the report acknowledges that fossils on federal lands often deteriorate or are lost through theft, vandalism, and other causes, primarily because of lack of personnel and fiscal resources dedicated to their protection. To combat these problems the report advocates increasing the penalties for fossil theft and damage; improving the education of federal land managers, prosecutors, law enforcement personnel, and the judiciary; and increasing the number of field personnel.

Noting that paleontological inventories are a vital component of effective management, the report calls for increased emphasis on fossil inventorying, using modern technology and regional approaches across agency lines. It further advocates the use of modern technology to improve curation and access to fossils by the public and amateur and professional paleontologists alike. Finally, the report emphasizes the need for public involvement in the appreciation and stewardship of fossils.

The National Park Service had a large role in shaping the content of the fossil report. It did so through an effective, interdisciplinary NPS team comprising policy and technical staff from the Geologic Resources Division, several parks, the Ranger Activities Division, and the Museum Management Program. Members of the NPS team participated in all of the agencies' meetings, developed two rough drafts of the report, researched applicable law, contributed significantly to several sections of the final report, and drafted the report's executive summary and Secretary Babbitt's transmittal letter.



▲ **An estimated 9,600 pieces** (12 tons or 10.9 metric tons) of fossil wood are stolen annually from Petrified Forest National Park, Arizona, a statistic that represents a general problem in national parks and on other federal lands. A 2000 report to Congress detailed numerous suggestions for increasing the protection and appreciation of fossils on federal lands. Copyright Jeff Selleck

Although it is not yet known how Congress will react to the final report, the fact that the November draft received an overwhelmingly positive response from the public suggests that the National Park Service's time and effort in this project were well spent. The report can be viewed on-line at www.doi.gov/fossil/fossilreport.htm.

# Off-road vehicles in Big Cypress to be managed in consideration of natural resources

✎ By Robert V. Sobczak and Antonio J. Pernas

✉ bob_sobczak@nps.gov
Hydrologist, Big Cypress National Preserve, Florida
✉ tony_pernas@nps.gov
Exotic Plant Management Specialist, Biological Resources Management Division

In 2000, Big Cypress National Preserve, Florida, took a big step toward managing off-road vehicles (ORVs) for the preservation of natural resources. During the year, the National Park Service published its new plan for the management of ORVs, coinciding with growing concerns about the suitability of ORVs throughout the national park system, including snowmobiles in Yellowstone National Park, dune buggies in Mohave National Preserve, and most recently swamp buggies and airboats in Big Cypress.

The 729,000-acre (294,840-hectare) Big Cypress National Preserve comprises the eastern third of the Big Cypress Swamp in southern Florida. The preserve was established in 1974 to protect the upstream watershed that is vital to western Everglades National Park and to prevent development in the fragile Big Cypress Swamp. Use of ORVs in Big Cypress National Preserve predates its establishment; the enabling legislation permits the use of ORVs in the preserve.

The Big Cypress Swamp has historically been a remote environment without roads that loggers, hunters, and trappers have accessed via custom-built vehicles such as swamp buggies and airboats since the 1940s. Today recreationists, hunters, and backcountry camp owners use ORVs to traverse the mosaic of semiflooded sawgrass prairies, cypress forest, and pinelands.

*"Trail accretion … signifies that natural soil recovery is not keeping pace with the rate of impact."*

Nearly three decades after the establishment of the preserve, the Florida Biodiversity Project, an environmental advocacy group, raised concerns about the management of ORVs in the preserve. In its subsequent review the National Park Service noted that ORVs were harming the environment. Aerial and ground-level photography highlighted soil disturbances, vegetation loss, and surface-water inundation and flow. Aerial photographs from 1940, 1953, 1973, and 1988 revealed that the total length of ORV trails had increased since establishment of the preserve. Trail accretion over time signifies that natural soil recovery is not keeping pace with the rate of impact. Hydrologic data indicated that the preserve was significantly wetter in the 1990s than during the 1970s and 1980s when hardened soil conditions prevailed. Soils that are subjected to inundation or prolonged presence of water near the surface are more prone to disturbance from vehicle overpass.

Technological developments since the inception of the preserve have raised new concerns about the ease of ORV access. Manufactured all-terrain vehicles now offer a low-maintenance, high-speed alternative to swamp buggies and airboats. More recently the proliferation of cell phones and global positioning systems has expanded the operators' abilities to navigate through remote backcountry regions.

▲ **Muddy off-road vehicle tracks** crisscross Big Cypress National Preserve, signaling disturbed vegetation, compacted soils, and altered hydrology. In 2000 the national preserve published a management plan for off-road vehicles that extends greater protection to natural resources while providing for ORV recreational use.

In response to the findings, Big Cypress National Preserve drafted a new Off-road Vehicle Management Plan and began its implementation in 2000. The plan is expected to meet the challenge of protecting the fragile natural resources of the preserve for public enjoyment while still providing access. Establishment of a designated trail system will end the era of unrestricted ORV access throughout the preserve. The plan also stipulates closures of heavily disturbed areas, the habitat of the Cape Sable seaside sparrow, and pristine areas. In addition it establishes a new three-pronged permit system requiring ORV operators to obtain a vehicle permit, an ORV operator's permit, and a backcountry permit. Finally the plan calls for initiation of monitoring, research, and restoration of natural resources that are affected by ORVs.

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## Award-Winner Profile — Maintenance Chief Merry Petrossian recognized with award

▲ **Merry Petrossian** (top left) and her staff at the USS Arizona Memorial, Honolulu, Hawaii.

Merry Petrossian, Facility Manager, USS Arizona Memorial, Hawaii, received the 1999 Director's Award for Excellence in Natural Resource Stewardship Through Maintenance. Merry has ensured that the memorial's Maintenance Division develops designs with resource stewardship as the primary outcome. Among the projects completed under her leadership were replacement of the worn visitor center teak deck with recycled material and installation of solar-powered lights in the parking lots. Merry also was instrumental in finding a solution to a major shoreline erosion issue and in developing an oil spill contingency plan for the park.

In 1996, Chevron spilled 40,000 gallons (151,400 liters) of oil into Pearl Harbor. The cleanup involved the placement of absorbent but abrasive booms and repeated high-pressure washing of the shoreline to remove the oil. This activity accelerated shoreline erosion at the park visitor center and also resulted in loss of the native naupaka *(Scaevola sericea)* shrubbery that protected the shoreline. High tides and heavy rainfall also destabilized and eroded shoreline soils. Merry acted quickly and designed a temporary sandbag system to stop the erosion; later she developed a new riprap system to prevent future erosion. The new system, funded through a 1999 settlement with Chevron under the damage assessment procedures of the Oil Pollution Act, was based on her input and knowledge of Pearl Harbor tides and currents. It incorporated the remaining concrete pilings and slabs and used naupaka and bougainvillea plants at the upper edge of the riprap to keep visitors away from the drop-off. The plantings require little maintenance and thrive in saltwater areas. The erosion prevention system is successful and the U.S. Navy now uses this design along its shorefront area adjacent to the USS Arizona Memorial property.

Merry believes that resource management is an important part of her job. "I never think when I'm undertaking a task ... 'How can I protect the natural or cultural aspects?...' In this cultural park I do alot of natural resource management... I'm natural, cultural, and a little bit rock-and-roll maintence."

## Exotic invertebrates spread

Two exotic aquatic species with potential to seriously harm native wildlife are spreading in St. Croix National Scenic Riverway (Minnesota and Wisconsin) and Yellowstone National Park (Wyoming, Montana, and Idaho). In summer 2000, reproducing zebra mussels (*Dreissena polymorpha*) were found within the lower 16 miles of the St. Croix River as far as Hudson, Wisconsin. The estimated density of the mussels at one location at Prescott, Wisconsin, was 9.3 per square foot (100 per square meter). The zebra mussel, a black-and-white-striped bivalve mollusk, came to North America from Europe. Since it was first discovered in Lake St. Clair in June 1988, it has spread rapidly and is expected to continue to do so throughout North America. The mussel disrupts aquatic ecosystems throughout its range and fouls beaches, clogs water intakes, and damages boat motors. Under the St. Croix River Zebra Mussel Action Plan, adopted in May 2000, the National Park Service and other federal and state agencies are continuing to inform the public about the problems associated with the zebra mussel. The agencies are also inspecting boats and trailers, restricting access to slow the spread of the mussel, and monitoring the spread of the infestation.

▲ **Zebra mussels** (cluster) threaten freshwater mussels native to St. Croix National Scenic Riverway by blocking their feeding, respiration, and reproductive structures.
St. Croix National Scenic Riverway

The New Zealand mud snail (*Potamopyrgus antipodarum*) was first discovered in Yellowstone National Park in the Madison River in 1974. Localized infestations in the river approached a density of greater than 28,000 individuals per square foot (2,604 per square meter) in 1997. Subsequent investigations by independent researchers documented a rapid spread of this exotic species to the Firehole and lower Gibbon Rivers. Although scientific studies of the snail's distribution have not been completed, park staff and researchers have observed that this nonnative, invasive species is continuing to spread into the park's interior. The long-term effects of this exotic species are unknown, but indications are that the snail is impacting the invertebrate community in the rivers it inhabits. Reductions in aquatic insect species diversity or abundance could in turn affect the famous recreational fisheries found in the park. It is not known how the New Zealand mud snail was introduced into the park, but human transport is strongly suspected. The park staff is continuing to monitor the spread of the snail and is conducting a public information campaign to control its expansion.